The Electrical Tickle

Stimulation of Plant Growth by Electricity, Magnetism, Sound and Light.

Part 2

by Mobius Rex

PO Box 19250
Jean, Nevada 89019, USA

MAGNETISM

The late Albert Roy Davis, a Florida physiologist and researcher on biomagnetism, received US Patent #4,020,590 (3 May 1977) for his system of gardening with magnetism. Davis recommended treating the seeds of plants that grow above ground in water with the south pole of a 1,500 to 2,500 gauss magnet. "We found after many years of research that treating above-ground seeds with the south pole of a magnet increases the germination and growth, and the leaves of these vegetables are larger."

"If you plan to treat seeds that result in plants with their edible portions underground, such as beets, potatoes, carrots or turnips, then you will produce a better result by using the north pole of the magnet," Davis said in an interview given to *Natural Foods and Farming* magazine in April 1981. The effects achieved are due to the magnetic influence of softening the surface tension of water, which is more readily absorbed by the seeds and plants.

According to U. J. Pittman of the Canadian Agricultural Research Station in Lethbridge, Alberta, "Earth's magnetism can affect the direction of root growth of some plants, and also the growth rate of some seedlings.

"The roots of some plants normally align themselves in a north-south plane approximately parallel to the horizontal force of Earth's magnetic field." Such plants include winter wheat, wild oats, spring wheat and some weeds. "Winter wheat seeded in rows running at right angles to the magnetic north often outyield wheat seeded in other directions by 3 to 4 bushels/acre because the roots grow in a north-south direction and utilise nutrients and moisture in the inter-row areas more extensively.

"Seeds of some varieties of wheat, barley, flax and rye were found to germinate faster and grow more during their seedling stages, when their long axes and embryo ends are pointed toward the north magnetic pole, than when they are pointed in any other direction.

"Many seeds germinate and grow about two times faster if they are exposed to the north pole of an artificial magnetic field before they are planted, than if they are not so treated—wheat seed in particular grows about five times as much in the first 48 hours as unexposed seed.

"In some species the enhanced growth rate persists through to maturity. Green snap beans thus mature more uniformly and yield more than those from untreated seed planted randomly.

"The effects of magnetic treatment before germination appear to remain active within some seeds for at least 18 months after application. The magnetic intensity required to give maximum response appears to be between 0.5 and 100 oersteds when applied for 240 hours. For some unknown reason, a greater growth response occurs if the seeds are subjected to magnetism for 48, 144, 240 or 336 hours than if exposed for intermediate periods. An exposure for 240 hours produces maximum responses in most seeds tested." (Ref.: U. J. Pittman, *Canadian J. Plant Sci.* 43:513-8 (1963); ibid., 52:727-33 (September 1972).)

The sexual determination of monoecious plants such as corn and cucumbers also is affected by the geomagnetic field: "If the embryo radical of such plants is oriented toward the north, a greater number of female flowers is formed than in the case of seeds oriented toward the south. Since cucumber fruits are produced from the female flower, northward orientation of the seed radicals will lead, of course, to greater yield per plant."

In general, northward orientation of the embryonic radical (particularly of corn) promotes femaleness, while orientation south encourages masculinity. Several investigations have revealed that the response of seeds when oriented toward the geomagnetic poles depends on the left- or right-handedness of the seed and the sexual characteristics of the plant type. When oriented with the tip of the embryo radical toward the south geomagnetic pole, laevorotary seeds have higher rates of growth, respiration and enzymatic activity and up to 50% greater yields. Likewise, dextrorotary seeds respond with 7% to 32% enhanced growth and yields when their embryo tips are pointed at the Earth's north geomagnetic pole.

Other researchers have found that exposure of seeds to magnetic fields increases the percentages of germinations of unchilled apricot and apple seeds, increases the yields of snap beans, accelerates the growth of legume and cereal seedlings...

When conifer seeds are sown with their embryo radicals oriented south, they germinate 4 to 5 days earlier than do seeds oriented toward the north pole. Phases of the Moon have a profound effect on the germination of conifers: when sprouted with their embryo radicals oriented south during a full moon, they will germinate faster than when germinated during the new moon.

If there is any doubt about the directivity or gender of seeds, positive results can be obtained in any case by two weeks' treatment in the magnetic null, the quiet region where the magnetic pull is balanced between north and south. This region is easily located by observing the patterns formed by iron powder scattered on a glass pane placed over the magnet.

U. J. Pittman also grew potatoes from excised, magnetically-treated eyes. The field-grown crop yielded about 17% more marketable tubers that weighed 38.5% more than those grown from untreated eyes! Pittman concluded that "Pregermination magnetic treatment of the eye may have effected a change in the metabolic process in the bud that eventually promoted earlier and greater tuber initiation. Tubers initiated early would have had more time to develop size than those initiated later."

Other researchers have found that exposure of seeds to magnetic fields increases the percentages of germinations of unchilled apricot and apple seeds, increases the yields of snap beans, accelerates the growth of legume and cereal seedlings and the rate of tomato ripening.

P. W. Ssawsotin reported that a low intensity (60 Oe) magnetic field may affect some biological processes as much as high intensity (1,600 Oe) magnets. Some of the effective 'windows' are quite narrow. Strekova et al. found that field strengths of about 60 Oe increased the growth rate of beans, cucumbers, lupins, maize and rye, but the rye was unaffected by a 100 Oe magnetic field. The greatest effects were obtained at the temperatures which are optimal for the growth of each plant type. (Ref.: *Planta* 12:327.)

Soviet scientists Lazarenko and Gorbatovskaya have reported "that wheat seeds and barley seeds, premagnetised in a magnetic field of intensity 2,000 oersteds for 30 minutes, germinate far more vigorously than the control seeds. Wheat seeds and barley seeds 'magnetised' with the major axis oriented with the magnetic flux, germinate far more vigorously than seeds oriented athwart the magnetic flux, and the germination of the latter seeds is actually retarded (as compared to the control seeds)...

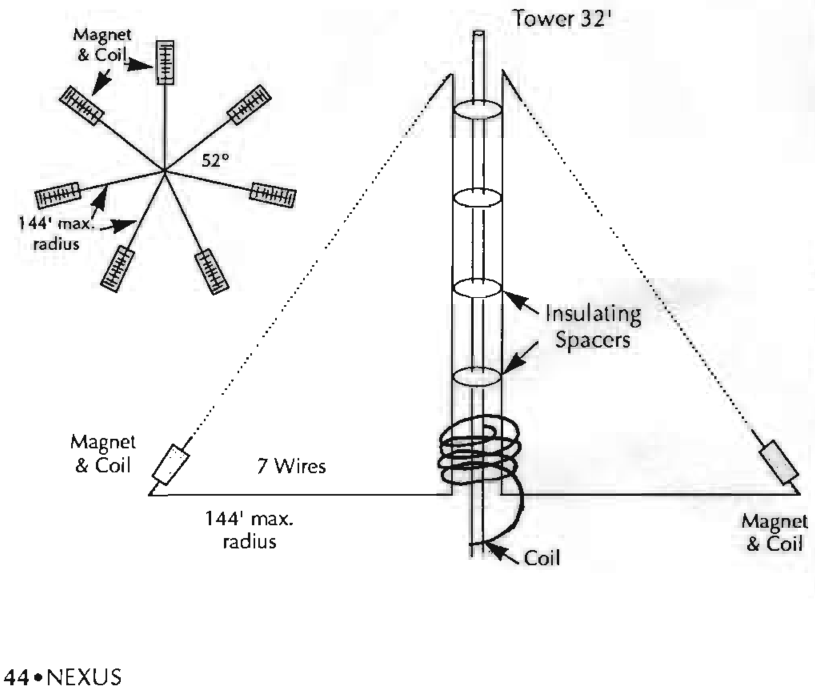
"Even more curious results were yielded by experiments in which seeds were heated in a test tube left for 30 minutes in boiling water... Compared to the control seeds, the seeds heated (in the dry state described above) and exposed to the magnetic field exhibited greater sprouting activity." (Ref.: M. A. Khvedelidze et al., *Applied Electrical Phenomena* 1(19):52-9, Jan-Feb 1968.)

However, it is possible to retard the germination of seeds if the magnetic field is too intense. V. Strekova reported on the "Effect of a High Intensity Constant Magnetic Field on Mitosis in Bean Roots". He found that four-day germination of bean seeds in a nonhomogeneous 12,000 Oe constant magnetic field causes suppression of the growth rate of the root system by up to 40%, and mutations. (Ref.: *Applied Electrical Phenomena*, no. 6, Nov-Dec, 1967.)

An excellent review of Soviet research into the "Electrical Protection of Plants against Disease" is published in *Applied Electrical Phenomena*, no. 6, Nov-Dec, 1966, pp. 454-8). The following excerpts pertain here:

"A constant magnetic field applied to cereal seeds gave the following effect: in the first variant with a constant field of 1,500 Oe and differences

Figure 5: DeLand's "Frost-Guard Tower"



in the period of exposure, the largest number of germinating seeds was found after an exposure of 10-30 and 300 minutes; in the second variant, when the exposure was constant and the intensity of the field varied, the effect again showed two maxima: the first in the region of low intensities and the second at 2,800 Oe.

"The Soviet scientist A. V. Krylov demonstrated the existence of the phenomenon of magnetotropism in the higher plants. Germination of seeds in a constant magnetic field accelerated growth of the shoots and rootlets and development at the south pole. An increase in the negative sign of polarity stimulated growth and development of the plant, while an increase in its positive sign promoted aging, disease and death. Polarity also plays a role in plant immunity. Seedlings with their rootlets turned toward the north magnetic pole were thickly infested by parasites and moulds, and the resistance of these seedlings was obviously depressed. The appearance of seedlings facing the south magnetic pole (with all other conditions the same) was completely different."

The growth of plants can be strongly stimulated by sound. The effect continues above the ultrasonic threshold of 20 kHz and levels off above 50 kHz. Frequencies of 4 kHz to 5 kHz in particular have been found to increase germination, enzyme activity and respiration.

In Florida and southern California during the 1940s, orange-grower John DeLand utilised his "Frost-Guard Tower" to replace the obnoxious smudge pot system and obtained amazingly high yields from trees formerly considered too old to be productive. The DeLand Frost-Guard Tower can protect one acre of grove with its energy field, but the system will not protect small plants like vegetables from frost. (Figure 5.)

As described by George Van Tassel, "The DeLand Frost-Guard Tower is about 32 feet high. It is composed of three 12-foot lengths of standard galvanised steel pipe. The lowest section is two-inch pipe, set three feet deep in concrete. On top of this, a 12-foot section of 1.5-inch pipe is screwed on by means of a reducer. Above this, the top section of 12-foot pipe, one inch in diameter, is screwed on by means of a reducer. Resting horizontally atop each reducer and at the mast head is a one-foot diameter disc of waterproof, 3/4-inch plywood. Near the outer diameter of each plywood disc or collar are drilled seven holes. These holes are parallel to the centre mast and are equally spaced around the diameter, 51-1/2 degrees apart.

"Beginning at the top of the mast, with an extension of 6 or 7 inches parallel to the ground, #10-gauge bare copper wires are run down through the seven holes of each plywood collar. These wires are continued through the concrete foundations' outer edge. From there they branch out, in 18-inch deep trenches, to a distance of not more than 144 feet from the mast's centre. At this point, each wire is wrapped several turns around an Alnico-V permanent magnet. The end of each wire is brought above ground and pointed back toward its corresponding other end on top of the tower. The magnet is given a coat of plastic to protect it from rust and to hold the windings in place.

"The trenches and magnets are covered with earth. The 18-inch depth is to protect the wires from cultivation; they must remain uncut if the system is to function. One wire on the tower, and hence in the earth, must point toward magnetic north. The placing of this first magnet must be done very accurately, and the others should be accurately placed.

"The magnets sets are inclined toward the mast at 34 degrees to the surface of the ground. Pointing the buried bar magnets toward the north magnetic pole, but also setting them so they point or tilt toward the central mast, gives a skew to the flux or flow of energy.

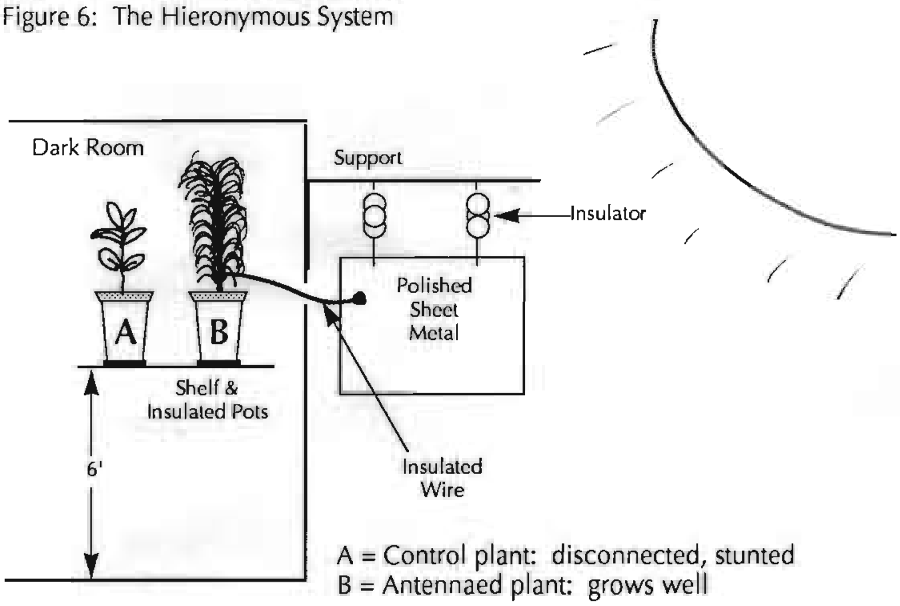
"This system has protected groves when temperatures have fallen to as low as 20 degrees Fahrenheit. The system does not alter the air temperature in the grove. Rather, it seems to effect a condition in the plants themselves, so that lower temperatures will not induce freezing. Fruit lying on the ground will freeze, however." (Ref.: G. Van Tassel, *Proc. College of Universal Wisdom*, 1974, Big Rock, CA, USA.)

Other experimenters have demonstrated that the high-frequency currents generated by a Tesla Coil will protect plants from temperatures as low as 10°F, which destroyed unprotected plants. (Ref.: A. D. Moore, *Electrostatics and its Applications*, J. Wiley & Sons, 1972, p. 452.)

ELECTROGENIC SEED TREATMENT

During the 1970s, the technology of electro-culture became embodied and marketed as "Electrogenic Seed Treatment" by Intertec, Inc. (now out of business for reasons unknown to

Figure 6: The Hieronymous System



this writer). Seeds were subjected to a variety of simulated atmospheric conditions that are known to benefit plant development and growth. The seeds were conditioned and rejuvenated, which resulted in more rapid germination, increased vigour and improved yields. The combined influences of the several different treatments incorporated in the Intertec machine results in a severalfold increase in plant germination, growth and yields! The inventors, A. Zaderej and C. Corson, published a description and explanation of "Electrogenic Applications to Plant Growth" (1977).

Seeds are first sprayed with a solution of minerals and enzymes which are implanted into the lipids (seed coat) by high-voltage negative-ion bombardment—a process known as electrophoresis. This accelerates chromosomatic activity. A second exposure to negative ion flux increases the implantation of the nutrient solution. Then the seeds are exposed to infra-red radiation which reduces the hard-seed dormancy and increases the metabolism of ATP.

The next stage instills an electrostatic charge of cathodic protection that considerably reduces the mortality rate of seeds by providing a source of electrons to buffer the reaction with free-radical nutrient ions. Seeds must be moist when treated by cathodic protection. Dry seeds may be damaged by this treatment, but damaged seeds may be repaired somewhat if they are moist. Cathodic protection increases viability and germination up to twice that of control seeds. In an electrostatic field of 36 kV/m, the negative pole above the plant enhances germination. The positive pole above the seeds inhibits germination.

The final step also treats seeds with select radio frequencies which stress the memory of DNA molecules, charge the mitochondria and intensify other metabolic processes. Radiofrequency treatment of seeds has been found to increase the degree of water absorption, electrical conductivity and oxygen uptake. The frequencies range between 800 kHz and 1.5 MHz with a field intensity of 3.2 watts/sq. cm.

Oddly, if not surprisingly, the seeds needed to be treated near where they were to be sown. The effects of Electrogenic Seed Treatment did not travel well, so seeds could not be shipped to it: the unit had to travel to the field.

SOUND

The growth of plants can be strongly stimulated by sound. The effect continues above the ultrasonic threshold of 20 kHz and levels off above 50 kHz. Frequencies of 4 kHz to 5 kHz in particular have been found to increase germination, enzyme activity and respiration.

Normally, the streaming movement of protoplasm in plant cells slows down in the early morning and evening, but this streaming can be accelerated by an audio frequency generator or electronic tuning fork used for 10 minutes at a distance of about five feet from the plants. The result is increased growth rate.

Moreover, plants should not be stimulated more than three hours daily during photoperiods, or the plants are rather liable to die within a month depending on the quality and intensity of the sound. The classical music of Europe and of Asia evoke the greatest response from plants. Very high frequencies and high volume cause cellular disruption and death. Rock and roll music has similar fatal effects in some circumstances. (Ref.: Dorothy Retallak, *The Sound of Music and Plants*, De Vorss & Co., Santa Monica, CA, USA, 1973.)

Dan Carlson, a plant-breeding scientist from Blaine, Washington, uses a 3 kHz tone and a foliar spray of trace minerals and amino acids in a process he calls "Sonic Bloom". [See NEXUS vol. 2, nos. 17 and 18.] Using this combination of sound and nutrients, Carlson has succeeded in producing "indeterminate growth" in plants. His first success was with a Purple Passion house plant that normally grows only about 18 inches. Under the influence of Carlson's Sonic Bloom treatment, the 17-year-old plant eventually reached a length of 1,300 feet and earned a place in the *Guinness Book of World Records*. The process is already being used by farmers in some 30 states and at least seven foreign countries.

"I read a book that said when plants heard sound, a 3,000-cycle hum, they seemed to open their stomata, they breathed better and got healthier." To induce plants to do that, Carlson developed a high-pitched blend of natural and musical sounds that is available in cassette form for home use and as a sound box for farm fields.

For more information refer to the advertisement on this page, or write to: Dan Carlson Scientific Enterprises, Inc., W. 7964 810th Avenue, River Falls, WI 54022, USA. (Ref.: *Minneapolis Star & Tribune*, 2 September 1986.)

MONOCHROME LIGHT

Plants respond to light with a complex variety of reactions which are affected by the duration (photoperiod), intensity and wavelength of the light. The scientific literature concerning plant photoperiodism includes several intriguing reports of experiments with single colour and intermittent light effects on plant growth.

Edward Babbitt and other experimenters during the 19th century reported that under the influence of blue light, the germination period of seeds is reduced to half the usual time; plant vitality is increased, growth is accelerated, stem and leaf development are improved and yields are increased. Babbitt used stained glass filters which passed only light of the same colour as the glass.

In 1861, General A. J. Pleasanton constructed a 2,200 sq. ft greenhouse in which every eighth pane was blue. He obtained phenomenal results in terms of increased yield, improved flavour, etc., and was granted US Patent #119,242 (26 September 1871) for "Improvements in Accelerating the Growth of Plants and Animals". He recommended a ratio of eight white to one blue light for optimal plant growth, and a ratio of 1:1 for best animal development. Blue light stimulates the directional response of plants to light. Plants' stomata open more widely in the presence of blue light. Evaporation and photosynthesis are intensified and chlorophyll production is accelerated. However, some cells may rupture, and mitosis may be inhibited.

Recent experiments have shown that the helium-neon laser (632.8 nm) can influence the phytochrome-controlled germination, growth and development of plants from a distance of more than a quarter-mile. The maximum effect is obtained by one or two minutes of exposure to reflected laser light. More than ten minutes of irradiation will inhibit the phytochrome response. In some cases, successive nightly irradiations at low intensity have significantly greater effect than a single exposure of greater length or intensity. The response can be reversed by alternating exposure to the laser and far-red light. (Ref.: L. G. Palea, *Nature* 228:970-3 (1970).)

Far-red light can be used to increase the growth of some plants (such as beans) up to ten times the normal rate by increasing phytochrome activity. Red light at 660 nm stimulates growth, development, flowering and fruiting. When red light at 700 nm is available with 650 nm red light, photosynthetic activity is considerably greater than with either single

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frequency. Blue light at 420 nm enhances the effect of 650 nm red light. Photosynthesis occurs at approximately 440 nm.

Photosynthesis can be increased up to 400% by means of intermittent light. The early experimenters who reported this effect used a rotating disc with a section removed to chop the light from a lamp. They found that 75% of the light from a given source could be blocked without decreasing the rate of photosynthesis. The improved yields produced by intermittent light depends on the frequency of the flashing. A frequency of four flashes/minute resulted in 100% increased yields. The amount of work done by the light can be increased by shortening both the light and dark periods. Warburg obtained 100% increased yields by using 133 flashes/second. Emerson and Williams improved the yield over continuous light by 300% to 400% using only 50 flashes/second, and making the light flashes much shorter than the dark periods. The necessary dark period is about 0.03 seconds at 25°C. The light reaction proceeds at about 0.001 second, and depends on the concentration of carbon dioxide. (Ref.: A. M. Dycus and Alice Schultz, *Plant Physiology* Supplement no. 39.)

A plant can be grown in complete darkness if it is connected by an insulated wire to a large metal surface which is exposed to sunlight. The plant is to be in a basement closet and it must be at least six feet above the ground and insulated from the shelf to generate a potential difference or antenna effect. The optimal size of the metal sheet must be determined by experiment so as to avoid sunburn (too large) or yellowing (too small). Plants which are connected in this manner will grow in complete darkness, but unconnected control plants will of course be stunted and lacking chlorophyll. (Figure 6: The Hieronymous System.)

But enough is... Any of the techniques described here can greatly ameliorate crops. This knowledge is a powerful weapon in the war against hunger—if you practise it!

FURTHER READING

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